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fears of the people and avoiding all unnecessary risk to the inoculated, and, further, with a view to enabling the inoculations to be carried on with the least possible amount of attendant inconvenience, we would insist upon the necessity that stringent precautions should be taken to insure that all the vaccine used is quite free from contamination, and we would recommend that the volume of the necessary dose should be made as small as possible.

III. With a view to removing any possible ground for distrust as to the conveyance of disease by inoculation from one person to another we would recommend that the syringe should be sterilized in the presence of the person about to be inoculated.

IV. We are of the opinion that inoculations, under the safeguards and conditions stated above, should be encouraged wherever possible, and, in particular, it seems to us desirable to encourage inoculation among disinfecting staffs and the attendants of plague hospitals.

We cannot bring to a conclusion this consideration of anti-plague inoculation by Mr. Haffkine's prophylactic fluid without expressing our sense of the importance of the method which Mr. Haffkine has devised and of the results which have been achieved by it. The credit due to Mr. Haffkine is the greater because the difficulties with which he had to contend in this matter could only have been overcome by great zeal and endurance. Mr. Haffkine's work on anti-plague inoculation, while not based on any new scientific principle, constitutes, it seems to us, a great practical achievement in the region of preventive medicine.

SPIRIT-LORE OF THE MICRONESIANS.

RECENTLY the director of the ethnographic division of the royal museums at Berlin has returned from a prolonged visit to the Sunda islands, Micronesia and Melanesia, and is now able to give to the world the multifarious results of his observations and researches. Micronesia had heretofore been studied in part only, as far as its ethnography is concerned, and it was chiefly the Pelew islands that had attracted a share of attention from German scientists; although the Mariana islands had been consid-

ered also. Research has now been made much easier by the number of colonies which Germany has established in this insular domain.

The entire group of the Carolinian islands, with a native population of about 30,000, is what Director Adolph Bastian chiefly describes in his recent publication, '*Die mikronesischen Colonien aus ethnologischen Gesichtspuncten*,' Berlin, 1899. Octavo, pp. 7 and 370. To begin with, Dr. Bastian gives a sketch of the social life of the Pelew nation, of their chiefs, notables and government. Then follow his observations on mortuary rites, their theories about death, the soul after death and the mutual intercourse of souls. Then are discussed Malay theories of black and white magic (whatsoever this may be), of demonology, the tutelary genii, the creation of the world, evolution and what we call the infinite. The demonology is among the Malays weird and fantastic, as might be expected, but also highly poetical and full of originality. For many years back the white race has been informed of the religious views and mythology of the Maori, the Samoa, Tonga and Mangaia islanders, and there is no denial of the fact that the cosmogony and spirit-worlds of these natives are as grand in their conception as those of many peoples of European antiquity. Their systems of the world and of after-life come very near the metaphysical, and when the European who transmits these views to us is himself a philosopher, or at least a thinker, he will make the Malay systems appear to us so much the more philosophical. Dr. Bastian, being a votary of the comparative method in ethnology, has for every myth, custom or belief a score of parallels ready, which he takes from Mediterranean, African, American or any other tribes or nations of the globe, or historic comparisons of beliefs from Greece, Rome, Mesopotamia, China, or Mexico. Anyone able to follow Bastian in his vast amount of reading (his quotations of sources are *summary* and therefore of little use), will undoubtedly derive benefit from what he states. But these statements are given in a manner that is too chaotic and profuse and most readers find it too difficult to follow the thread of his argumentation.

Oracles through whistling are found throughout these islands. Their main gods transmit

their behests to men through ghosts or dead children by whistling sounds or whispered words. Tattooing is permitted only when a deity has given his assent by whistling; house spirits and the genii of trees give their revelations by whispers only.

A. S. G.

APPLIED THERMODYNAMICS.

IN a recent publication of '*Documents sur la Laboratoire de Mécanique de l'Université de Liège*,' describing its methods of instruction, by the Professor of Applied Mechanics and of Industrial Physics, M. Dwelshauvers-Dery, we find a *résumé* of researches in applied thermodynamics, mainly in the experimental study of the steam-engine, which is interesting as exhibiting the character and extent of the work recently performed, and valuable as supplying important data previously unknown.

This laboratory of applied mechanics was completed in 1893, after, as the author of these documents says, five years of constant solicitation of the government to supply this '*auxiliaire précieux*,' of which M. Dwelshauvers-Dery was the first to conceive the idea, a generation ago, though so late in its realization. His idea was that of a laboratory of research and instruction in engineering, to be employed in the work of the regular courses leading to technical degrees and devoted to the purposes of the student, rather than, as previously usual in nearly all departments of applied science, primarily for those of the distinguished professor in charge and only secondarily and incidentally for the student.

The researches which have been conducted since the date of completion of this laboratory by the Director, assisted by his staff and by advanced and able students, have been mainly in applied thermodynamics. M. Dwelshauvers-Dery is a disciple of Hirn and aided in the investigations made in Alsace at the beginning of the work of his eminent leader. Since that time, the famous discussion between Zeuner and Hirn and their followers has made this work and these workers familiar to all investigators and students in that field. It has been in the supplementing of Hirn's earlier work that the experimental steam-plant at Liège has been mainly occupied recently.

Among other investigations, those relating to the influence of the water collecting in the steam-chest of the engine upon its efficiency, on the effect of superheating, on the use of the steam-jacket, on the effect in the real engine of compression, and those on the condition of the vapor, as to 'quality,' in the clearance spaces, have been the most extensive and important.

It was found to be the unquestionable fact that, with the engine employed, it was advantageous to continually drain the water of condensation from the valve-chest of the engine when using moist steam and whether the jacket is in use or not. With superheated steam, naturally, no effect was observed.

The steam-jacket was found to give an economy of from 24 to 28 per cent., either with or without superheating; the latter being a disputed question until thus, for this case, at least, settled. Superheating produced an economy of about 20 per cent., as a maximum.

The investigations of the quality of the vapor in the compression period occupied several years and attracted much attention and some opposition to the conclusions reached was manifested by a number of distinguished experts in that department. Those experiments which were made with 'constant absolute work' showed a decided loss by compression and a loss proportional to the amount of the compression; which fact was attributed to the heat-exchanges between vapor and cylinder-wall. This conclusion was challenged and it was denied that the fundamental assumption that, as asserted by Hirn, the steam at the end of emission is dry, could be accepted as true. Dwelshauvers-Dery and his former assistant and pupil, Duchesne, furnished proof of the correctness of his proposition. (*Revue de Mécanique*, Jan., 1899; July, 1899.)

Mr. Isherwood, the famous pioneer in this class of work and the Engineer-in-chief of the navy during our civil war, suggested that the experiments be repeated, making the 'indicated work' a constant quantity. He thought it possible that it might be found that the use of compression was neither economical nor wasteful in the actual case and, therefore, its use simply a question of smoothness of operation of the machine and entirely outside